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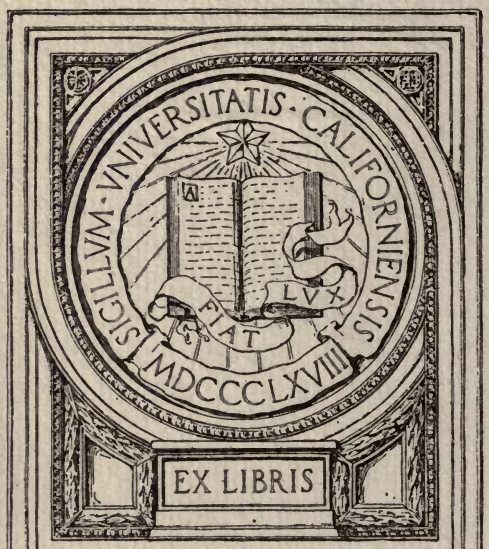

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METHOD OF INVESTIGATION AND TEST OF

SMOKELESS POWDER

FOR SMALL ARMS AND CANNON

FEBRUARY 10, 1910
REVISED JULY 25, 1913
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METHOD OF INVESTIGATION AND TEST OF SMOKELESS POWDER FOR SMALL ARMS AND CANNON.

I.—INFORMATION TO BE FURNISHED BY THE INVENTOR.

1. Form of granulation.
2. Chemical composition (confidential if desired).
3. Method and facility of manufacture (confidential if desired) and time required for manufacture.
4. Relative strength or force as compared with black powder or with nitrocellulose smokeless powder; if estimated, explain method; if determined by experiment, state how. If not known, so state.
5. Results of tests, if any, that have been made to show—
(*a*) Safety in handling.
(*b*) Keeping qualities under exposure to moisture, heat, cold, and continued storage.
6. Actual firing tests from guns, if any.

NOTE.—Concise answers under the separate headings are desired.

II.—LABORATORY EXAMINATION TO BE MADE.

Make as many of the following tests as are applicable to the powder submitted:

1. Make complete quantitative chemical analysis, and determine calculated force and temperature of explosion.
2. Analyze the products of combustion.
3. If the chemical analysis indicates a possibility of detonation, determine this by exploding successive samples of the powder, using detonators of increasing strength.
4. Determine sensitiveness to shock and friction as compared with nitrocellulose smokeless powder by firing bullets at varying velocities through layers of varying thickness, depending upon the granulation of the powder.
5. Determine specific gravity and gravimetric density.
6. Note hygroscopic qualities.
7. Determine residue from flash and mineral ash as approximate measures of fouling qualities.
8. Determine degree of smokelessness as compared with nitrocellulose smokeless powder.

9. Determine stability by making as many of the following service stability tests for smokeless powder, or modifications thereof, as the composition of the powder submitted will permit of—

(*a*) K. I. starch test at 65.5° C. and 82° C.

(*b*) 135° German test (run for 5 hours).

(*c*) 115° Ordnance Department test.

(*d*) Surveillance test at 65.5° and 80° (carry to red fumes or explosion).

(*e*) Surveillance test at 40° C. (carry to whitening of N/10 M. V. paper).

10. Determine temperature of ignition.

11. Determine the melting point, if any, or if the powder is a mechanical mixture of chemical compounds some of which have melting points, determine them.

12. If powder is for cannon of 3-inch or greater caliber, determine the toughness of the grains by making a compression test on grains cut so that the length is equal to the diameter, and by side-impact test.

13. Determine the rapidity of burning in open air as compared with that of nitrocellulose smokeless powder.

III.—GENERAL REQUIREMENTS.

A satisfactory powder for small arms and cannon should comply with the following requirements:

SAFETY AND INSENSITIVENESS.

1. Should be reasonably safe in manufacture and free from very injurious effects upon the operatives.

2. Should not be very much more sensitive to ignition by bullets fired into it than nitrocellulose powder.

3. Should be incapable of detonation by the strongest detonator.

4. Should not produce any more erosion of the bore than produced by the present nitrocellulose smokeless powders.

5. When a grain or a cylinder of the powder is cut so that its length is equal to its diameter, and is then compressed along its axis, no cracks should appear before the total compression is 35 per cent of the original length.

6. The powder should not show undue brittleness by any other established test.

7. The rapidity of burning of the powder when ignited in the open air should not be very much greater than that of nitrocellulose powder of similar granulation.

8. The products of combustion must not be poisonous to an objectionable degree.

BALLISTIC REQUIREMENTS.

1. The powder must, with proper granulation, be capable of giving at least the adopted muzzle velocities in all the service guns, within the maximum pressures prescribed for them.

2. The heating of the service guns when fired with the adopted muzzle velocities must not be greater than that produced under like conditions by nitrocellulose powder.

3. The powder must be practically smokeless, and must not unduly foul the bore.

4. It must not require an unduly strong primer for ignition.

5. The products of combustion must have no more chemical action on metals than those of nitrocellulose powder.

STABILITY.

The following are minima requirements (longer tests highly desirable):

1. The powder must not explode in less than five hours when subjected to the 135° German test.

2. The powder must not give red fumes nor explode in less than 60 days when subjected to the surveillance test at 65.5° C.

3. The powder must not give red fumes nor explode in less than 30 days when subjected to the surveillance test at 80° C. nor whiten the N/10 M. V. paper in less than 60 days when subjected to the surveillance test at 40° C.

4. After prolonged storage at the ordinary temperature the powder must show no marked loss in stability as measured by the preceding tests nor any material change in the charge-velocity-pressure relations.

5. The powder must show no marked change in any of its characteristics between temperatures of −15° C. and +50° C.

6. The powder must be practically nonhygroscopic. If the powder contains any ingredients soluble in water, it should be definitely stated.

GENERAL.

Supply of raw material.—It should be possible to secure all the raw materials entering the powder in this country without undue delay and at a reasonable cost.

Granulation.—It is desirable, but not essential, that the powder permit being granulated in such a way that the burning surface of a grain increases with the proportion of the grain burnt.

Machine loading.—When granulated for small arms, the powder should be capable of being machine loaded.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, January 18, 1917.

February 10, 1910.
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